PtDrive Proof-of-Concept Prototype Testing

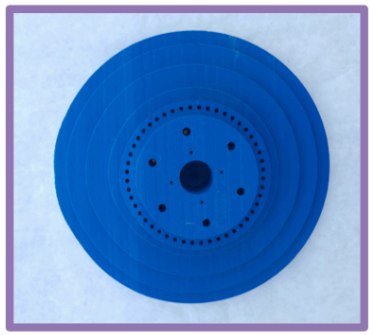
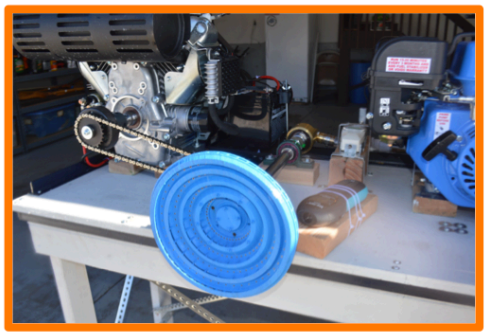
Based on the

DiscThruster™ Configuration

For

Progress Thru Early February 2017



13 February 2017

Brad Pande

File: iPropulsion – DiscThruster Testing (13-Feb-2017) Rev 3.pptx
Author: Brad Pande

Prototype Background

FIRST… Go to: https://www.ipropulsion.com and press this **How DiscThruster Works** button to understand how the concept works

PtDrive is a **P**ressure **t**hrust **D**rive Propulsion Engine

- PtDrive targets rocket and 30,000 lbf (133,400 N) class turbofan engine market
- Prototype testing described here is based on the DiscThruster. Other versions exist
- PtDrive is a non momentum propulsion (NMP) drive, such that thrust is produced but no mass leaves the system. Its based on the accepted rocket equation, and does not violate Newton's third law. EmDrive is also in the category of a NMP drive, operating on a different principle

DiscThruster Ongoing Testing to Date

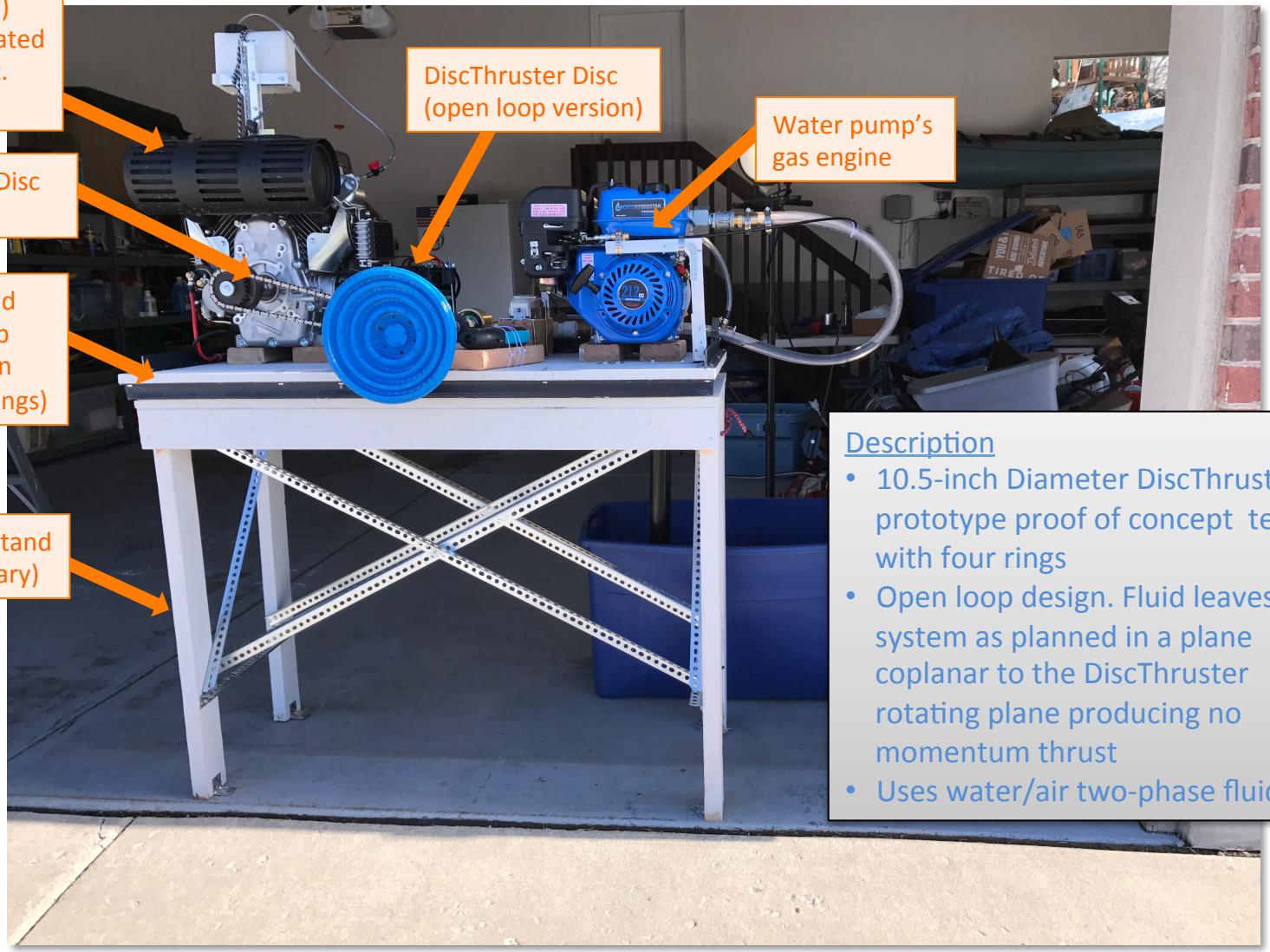
- A 10.5-inch dia. DiscThruster disc was manufactured using 3D printing and PLA plastic
- The basic sonic choking nozzle metal inserts were previously bench tested at different pressures and with different two-phase flow parameters, to experimentally determine magnitude of pressure thrust and ratio between pressure thrust and momentum thrust
- DiscThruster has 192 nozzles equally distributed among four rings

Prototype Background (Cont.)

DiscThruster Ongoing Testing to Date (Cont.)

- A thrust stand was constructed in early winter as shown on page 4. It contains the DiscThruster, 22 hp (16.4 kW) gas driving engine derated 15% to 5,000 ft. testing altitude, two-phase fluid supplying water pump, and various support equipment
- A number of static non spinning and rotating DiscThruster shakedown tests, the part of a larger design of experiments, were conducted in January 2017
- A series of high power testing is just beginning in February as shown on page 8 with some preliminary findings
  - Open loop testing only to date. Open loop means two-phase fluid is not retained
  - No results to report. Results to be published upon successful completion (not a claim) of open loop testing. Open loop testing not technically a NMP drive
- Upon completion of open loop testing an impulse water turbine coupled to the drive shaft, and a collection scroll will be added to convert over to a closed loop system
  - Fluid leaving the DiscThruster's outer circumference will pass through the turbine, transferring power to the drive shaft through a gear system
  - After passing through the turbine, the scroll will collect and direct fluid back to the water pump to complete the closed loop. Results to be published upon successful completion. Closed loop designed to demonstrate NMP drive

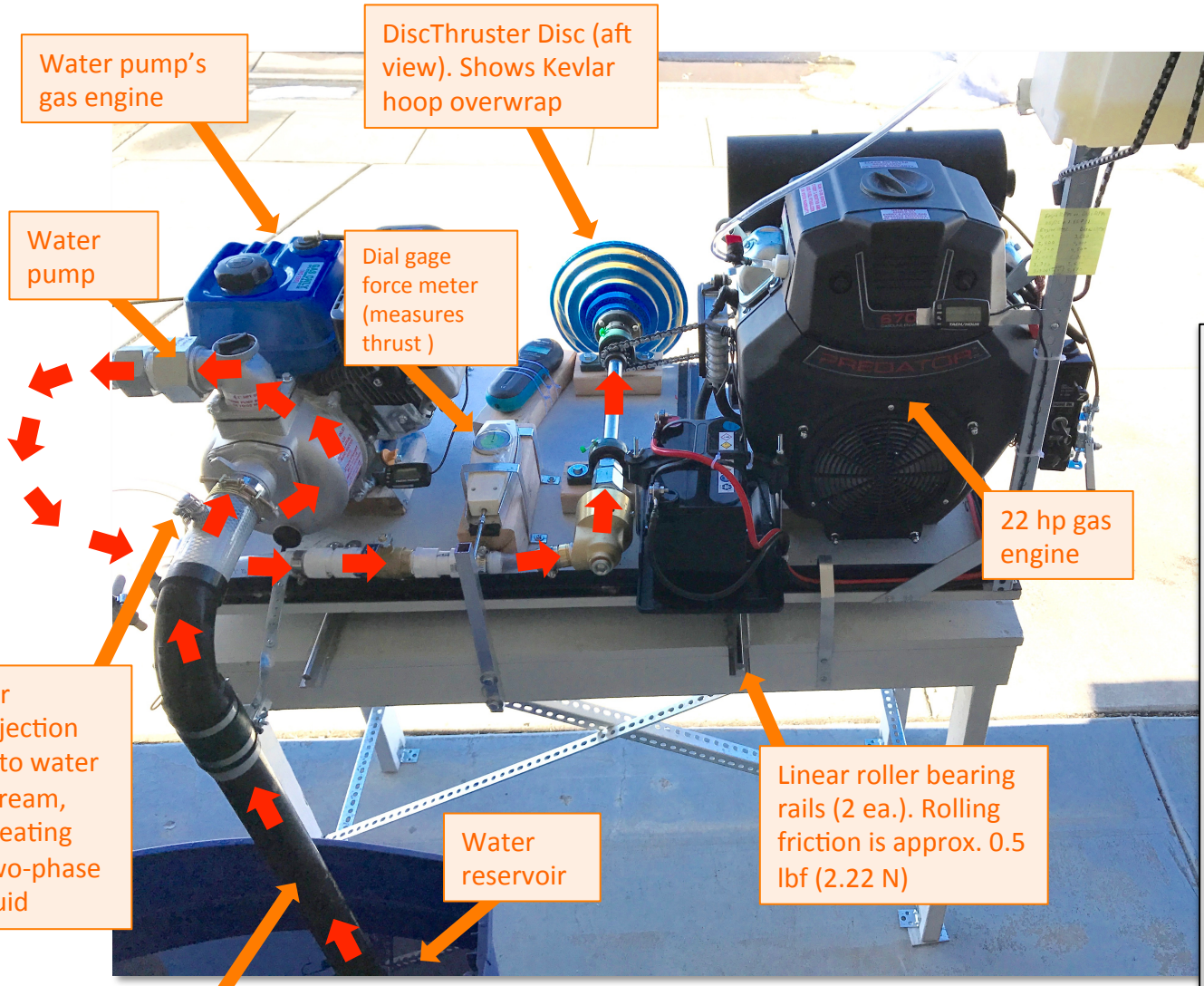
DiscThruster - Proof of Concept Prototype (Front View)



Description

- 10.5-inch Diameter DiscThruster prototype proof of concept test with four rings
- Open loop design. Fluid leaves system as planned in a plane coplanar to the DiscThruster rotating plane producing no momentum thrust
- Uses water/air two-phase fluid

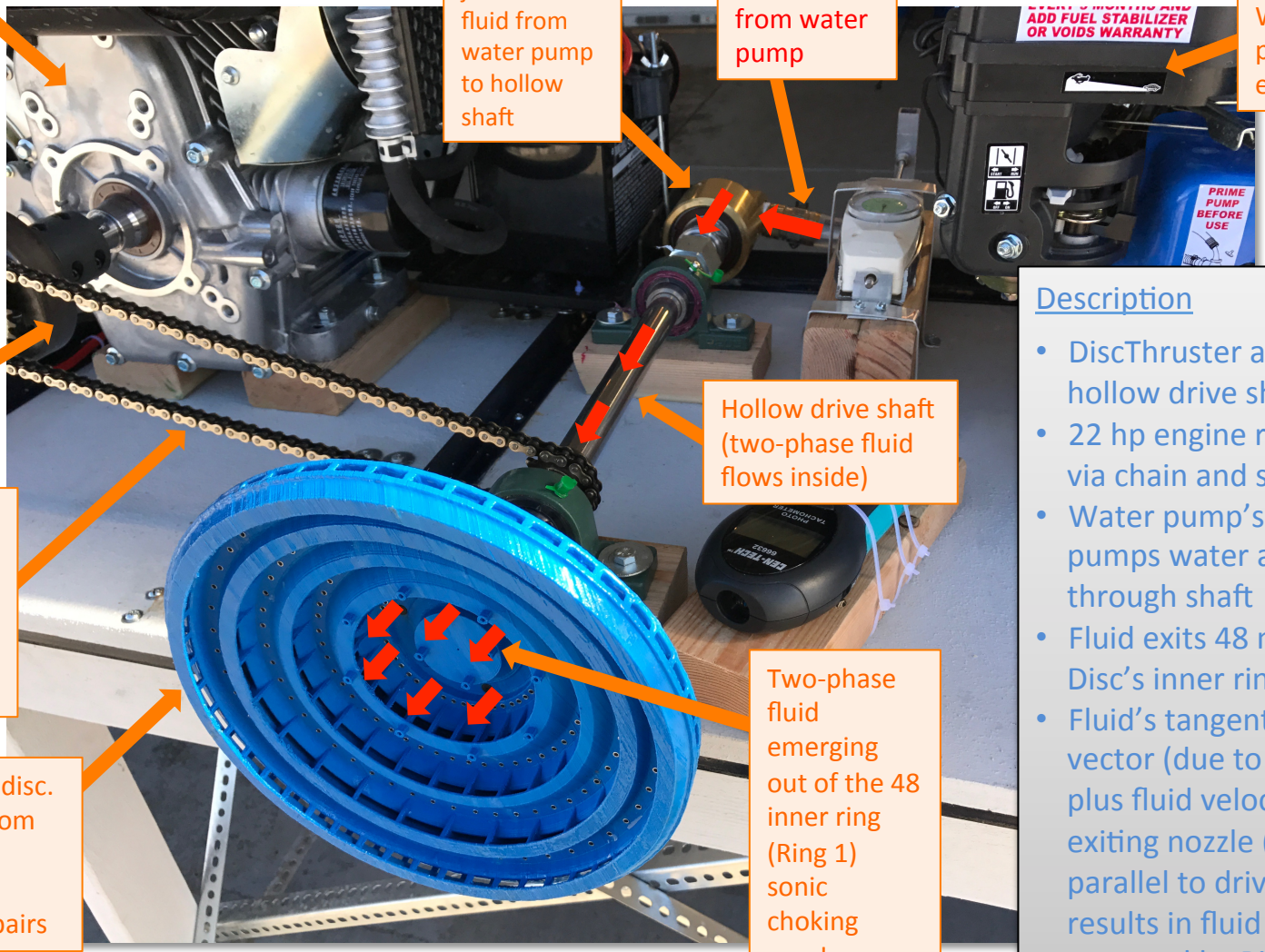
DiscThruster – How it Works (Back View)



Description

- Water pump's gas engine drives water pump
- Air injection into water flow creates two-phase fluid
- Water is drawn from reservoir
- Fluid flows to DiscThruster
- Dial gage force meter measures thrust by reacting against lower stationary thrust stand

DiscThruster – How it Works (Cont.)



22 hp gas engine

Rotating joint. Passes fluid from water pump to hollow shaft

Fluid path from water pump

Water pump's gas engine

Engine dry clutch

Hollow drive shaft (two-phase fluid flows inside)

22 hp engine-to-DiscThruster drive shaft chain. 1.667:1 overdrive gear ratio

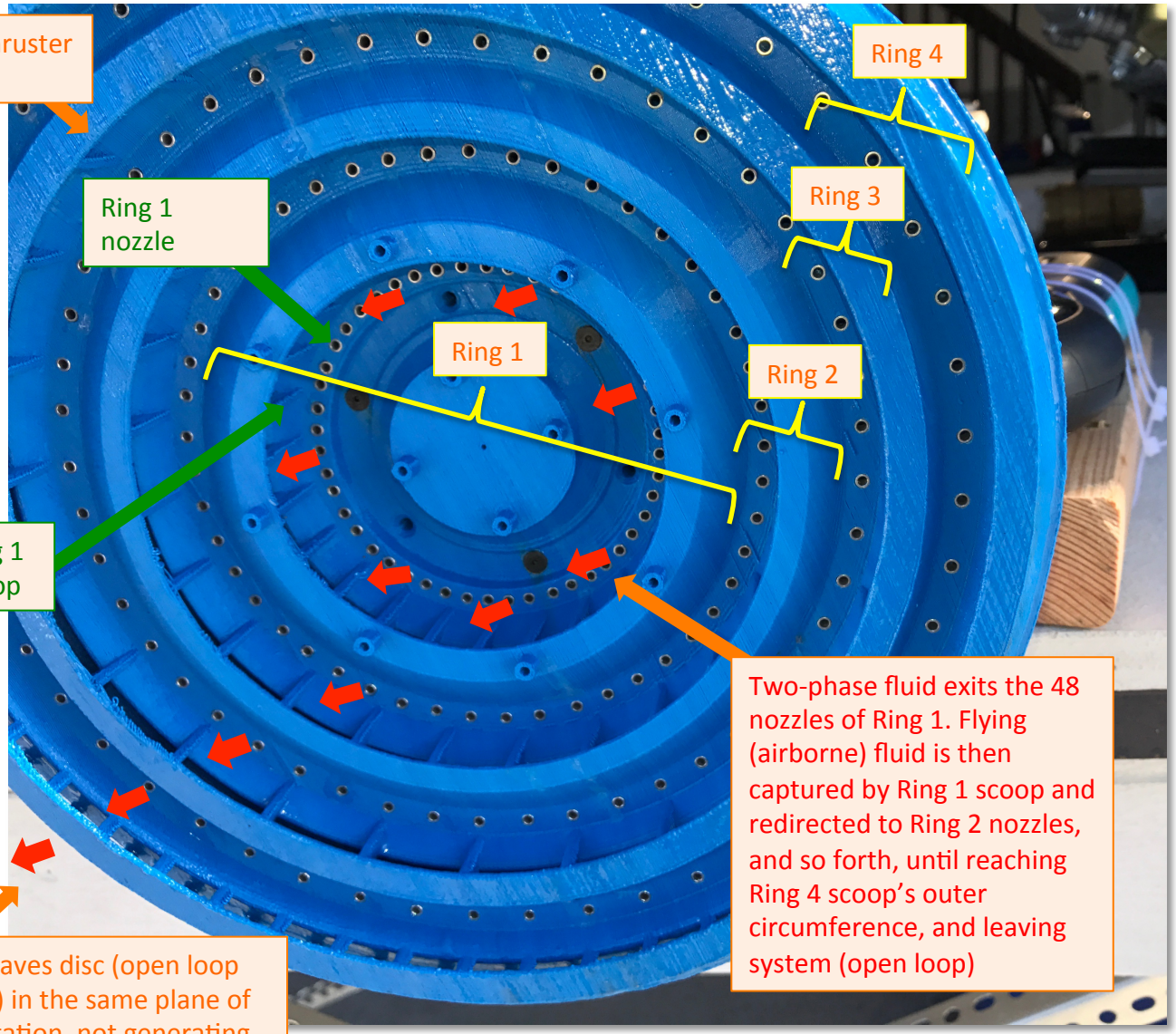
DiscThruster disc. 3D Printed from PLA plastic. Exhibits Four rings/scoop pairs

Two-phase fluid emerging out of the 48 inner ring (Ring 1) sonic choking nozzles

Description

- DiscThruster attaches to hollow drive shaft
- 22 hp engine rotates disc via chain and sprocket drive
- Water pump's engine pumps water and air through shaft
- Fluid exits 48 nozzles of Disc's inner ring (Ring 1)
- Fluid's tangential velocity vector (due to spinning) plus fluid velocity vector exiting nozzle (direction parallel to drive shaft) results in fluid being captured by Ring 1 scoop

DiscThruster – How it Works (Cont.)



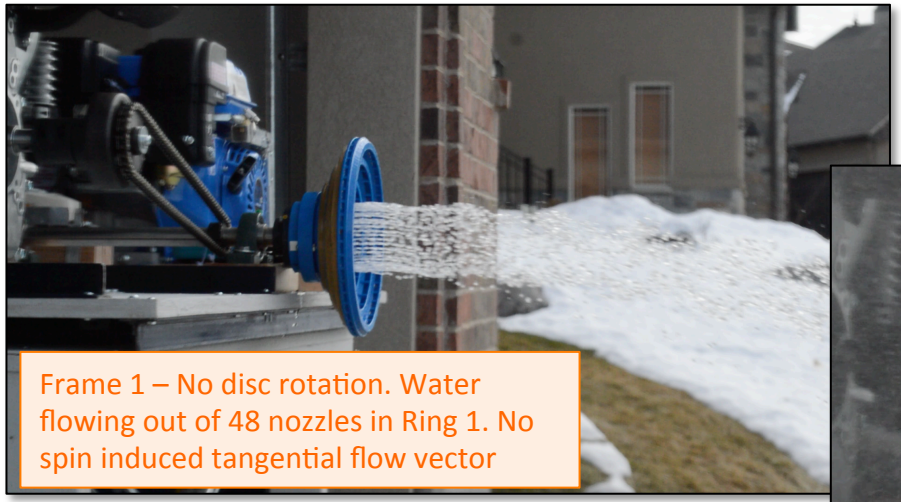
Description

- DiscThruster disc exhibits a series of ring and scoop pairs
- Two-phase fluid leaving Ring 1 nozzles flight time <5 milliseconds before being captured by Ring 1 scoop pair
- Fluid captured by Ring 1 scoop is redirected to Ring 2 nozzles and so forth
- Fluid passes through all rings until reaching disc outer circumference where it leaves the system (open loop)

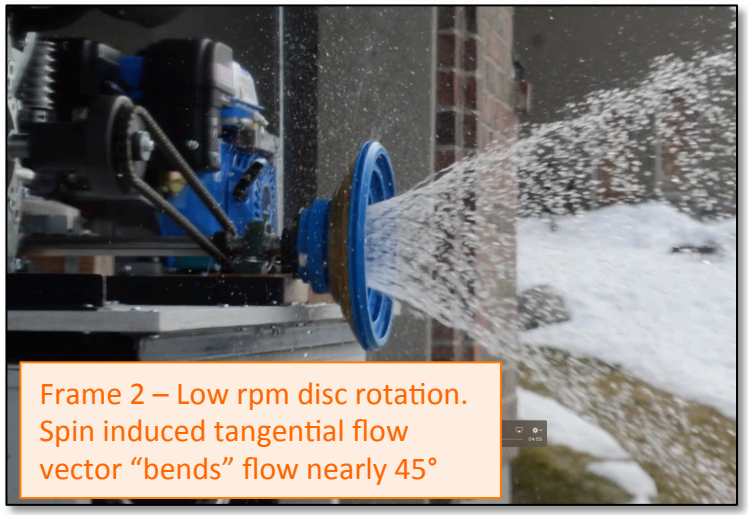
DiscThruster – How it Works (Cont.)

Description in Video Clip Frames

- DiscThruster open loop demonstrates how disc rings and scoop pairs retain fluid which is released only at outer circumference as planned



Frame 1 – No disc rotation. Water flowing out of 48 nozzles in Ring 1. No spin induced tangential flow vector



Frame 2 – Low rpm disc rotation. Spin induced tangential flow vector "bends" flow nearly 45°

Frame 3 – High rpm disc rotation. Spin induced tangential flow "bends" fluid leaving nozzle rings nearly 90° directing fluid to adjacent scoop. Fluid travels from ring 1 to scoop 1 to ring 2 to scoop 2 and so forth, finally reaching scoop 4, where it exits tangentially in the plane of disc rotation. No fluid travels forward so there is zero momentum thrust. This is a open loop test since fluid is not recovered. Closed loop tests will add a circumferential impulse water turbine and collection scroll to recycle fluid